

WHAT IS CLAIMED IS:

1. A polypeptide comprising in the amino-terminal to carboxy-terminal direction:
 - (a) a first polypeptide segment, wherein said first polypeptide segment has membrane anchoring properties; joined to
 - (b) a second polypeptide segment having a sequence selected from the group consisting of residues 75-114 of SEQ ID NO:12 and residues 75-114 of SEQ ID NO:14; joined to
 - (c) a third polypeptide segment having at least 40% sequence identity to residues 115-506 of SEQ ID NO:4.
2. The polypeptide of claim 1, wherein said third polypeptide segment has at least 50% sequence identity to residues 115-506 of SEQ ID NO:4.
3. The polypeptide of claim 2, wherein said third polypeptide segment has an aspartic acid at the position corresponding to amino acid 307 of SEQ ID NO:4.
4. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:20.
5. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:22.
6. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:34.
7. The polypeptide of claim 3, wherein said polypeptide has the amino acid sequence of SEQ ID NO:36.

8. The polypeptide of claim 1, wherein said polypeptide catalyzes the condensation of malonyl CoA and a C18 fatty acyl substrate, leading to the synthesis of a C20 fatty acyl CoA.

9. The polypeptide of claim 8, wherein said C18 fatty acyl substrate is an oleoyl substrate.

10. The polypeptide of claim 1, wherein said polypeptide catalyzes the condensation of malonyl CoA and a C20 fatty acyl substrate, leading to the synthesis of a C22 fatty acyl CoA.

11. The polypeptide of claim 10, wherein said C20 fatty acyl substrate is an eicosenoyl substrate.

12. A nucleic acid encoding the polypeptide of claim 1.

13. A nucleic acid encoding the polypeptide of claim 2.

14. A nucleic acid encoding the polypeptide of claim 3.

15. Host cells containing a nucleic acid encoding the polypeptide of claim 1.

16. Host cells containing a nucleic acid encoding the polypeptide of claim 2.

17. Host cells containing a nucleic acid encoding the polypeptide of claim 3.

18. The host cells of claim 15, wherein said host cells are yeast cells.

19. The host cells of claim 15, wherein said host cells are plant cells.

20. A plant containing an exogenous nucleic acid encoding the polypeptide of claim 1.

21. A plant containing an exogenous nucleic acid encoding the polypeptide of claim 2.

22. A plant containing an exogenous nucleic acid encoding the polypeptide of claim 3.

23. The plant of claim 20, wherein said plant is *Brassica napus*.

24. The plant of claim 21, wherein said plant is *Brassica napus*.

25. The plant of claim 22, wherein said plant is *Brassica napus*.